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(54) **SURGICAL ASPIRATION AND IRRIGATION**

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A61M 39/22 (2006.01)

(52) **U.S. Cl.**
CPC **A61M 1/0062** (2013.01); **A61M 1/0064**
 (2013.01); **A61M 39/22** (2013.01)

(58) **Field of Classification Search**
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See application file for complete search history.

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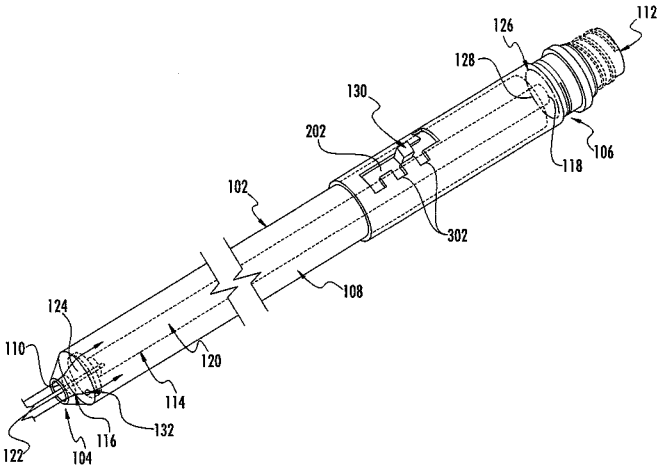
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(57) **ABSTRACT**

The present disclosure relates generally to surgical aspiration and irrigation devices, including methods regarding the same.

17 Claims, 4 Drawing Sheets



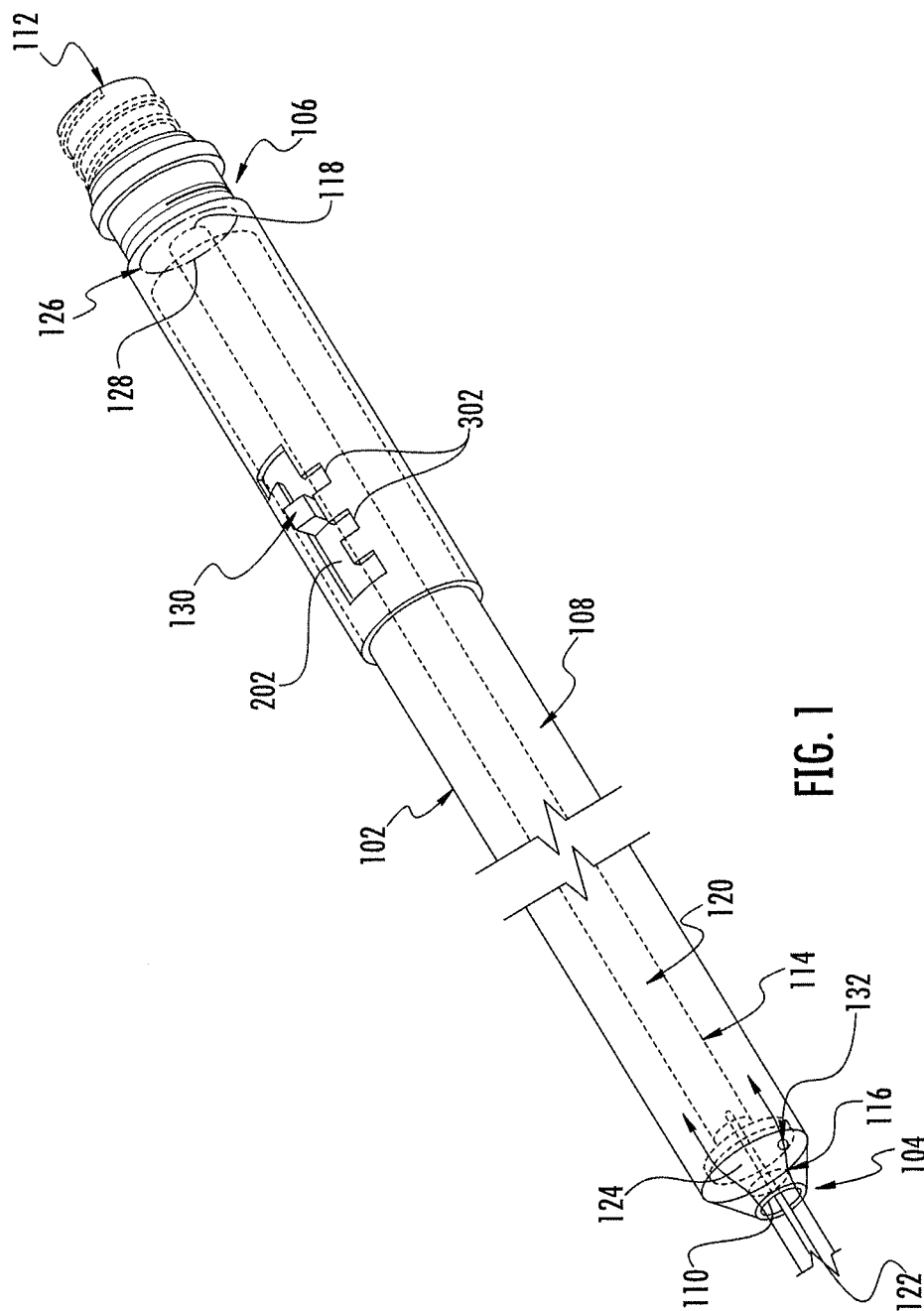
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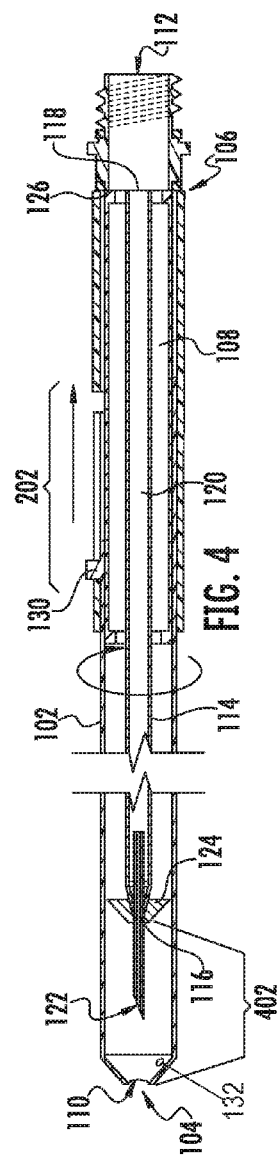
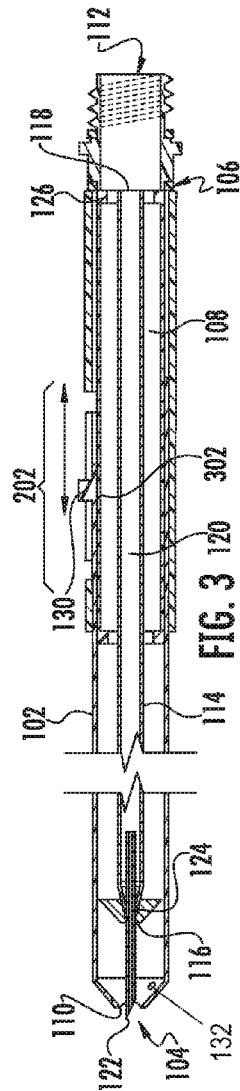
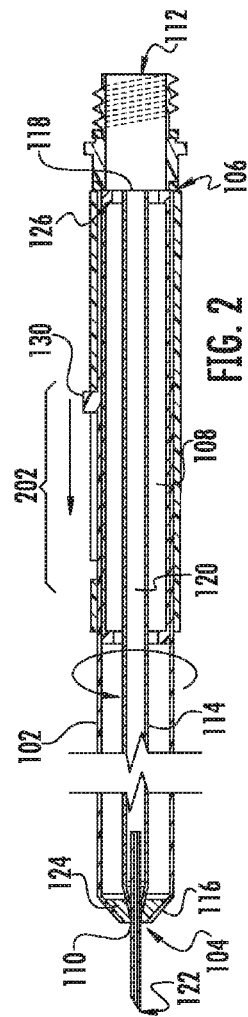
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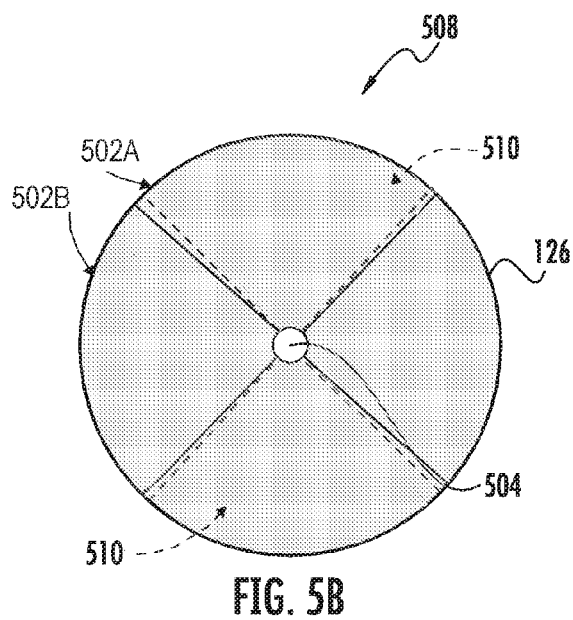
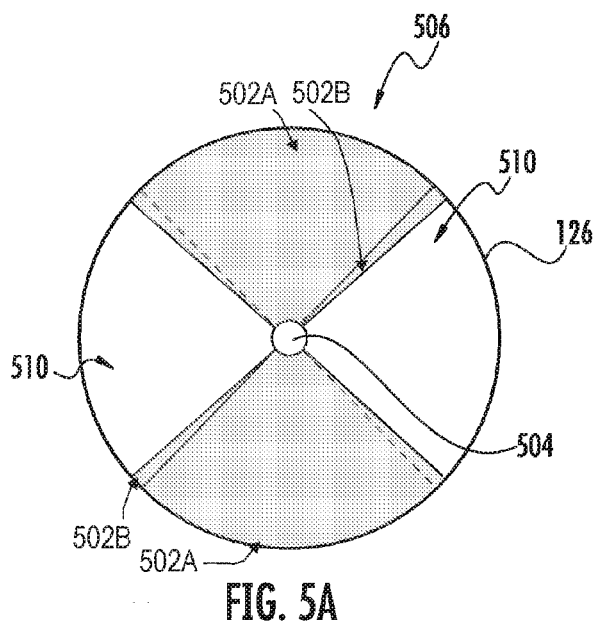
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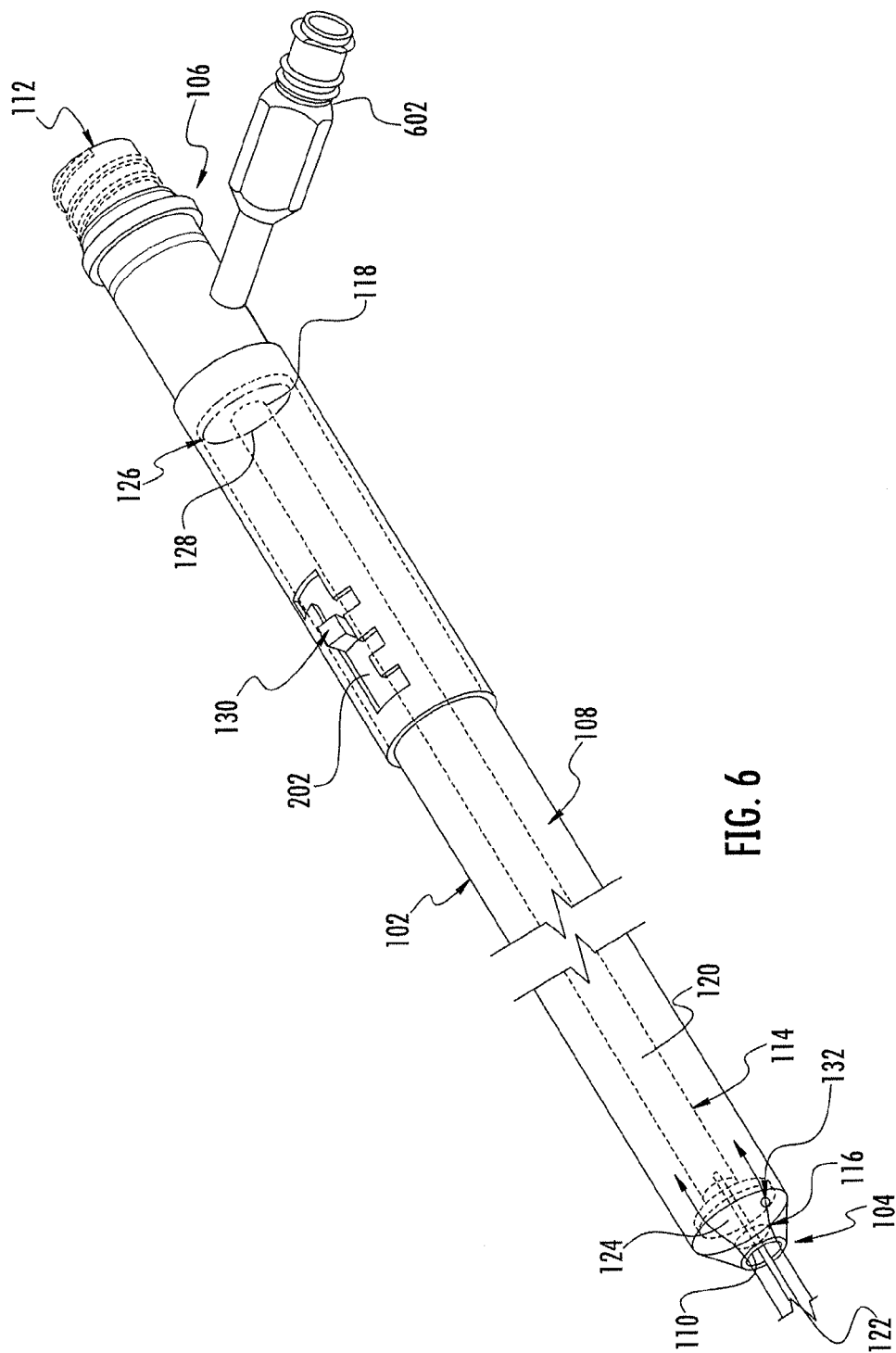
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SURGICAL ASPIRATION AND IRRIGATION**CROSS REFERENCE TO RELATED APPLICATION**

This application claims priority to and the benefit of U.S. Provisional Application No. 61/752,225, filed Jan. 14, 2013, entitled "SURGICAL ASPIRATION AND IRRIGATION," the full disclosure of which is incorporated herein by reference.

FIELD OF THE INVENTION

The present disclosure relates generally to surgical aspiration and irrigation devices, including methods regarding the same.

BACKGROUND

During medical procedures, doctors and other medical professionals routinely irrigate and/or aspirate the area of the subject around which or within which the medical procedure focuses. When aspirating target areas during these medical procedures, medical professionals often use a needle and syringe to aspirate the target area within the subject or patient. Needles pose a risk of injury to the subject and medical staff and can be difficult to manipulate laproscopically.

Furthermore, during certain medical procedures, it is necessary for a medical professional to irrigate and aspirate a target area simultaneously or at least to have the capability of alternating between irrigation and aspiration fairly quickly.

SUMMARY

The present disclosure relates generally to surgical aspiration and irrigation devices and methods regarding aspiration and irrigation by a single device.

Provided in the present disclosure is a surgical aspiration and irrigation device. The surgical aspiration and irrigation device includes an outer cylinder with a distal end and a proximal end. The outer cylinder forms an outer lumen, and the distal end of outer lumen includes a distal opening. The proximal end of the outer cylinder includes a connector. The connector connects directly or indirectly to a tube, syringe, and/or suction and irrigation handpiece or pump(s).

The surgical aspiration and irrigation device further includes an inner cylinder, and the inner cylinder is located within the outer lumen. The inner cylinder includes a distal end and a proximal end, and the inner cylinder forms an inner lumen. The distal end of the inner cylinder includes a needle and a stopper. The stopper is configured to close the distal opening of the outer lumen around the needle.

Also provided in the surgical aspiration and irrigation device is a valve positioned at the proximal end of the inner lumen. The valve is moveably positioned near the proximal end of the outer lumen. The valve selectively controls the aspiration and irrigation through the inner lumen and the outer lumen. Further, a seal is positioned about an outer circumference of the valve between the valve and the outer cylinder.

Also provided is a method for aspirating or irrigating a surgical target in a subject. The method includes insertion of a surgical aspiration and irrigation device, as fully described herein, into the subject. Irrigation or aspiration is then activated from the tube, syringe, and/or suction and irriga-

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tion handpiece or pump(s) connected to the surgical and irrigation device. The surgical aspiration and irrigation device is optionally inserted through a trocar in the subject. The surgical target may include an organ, a cyst, a tumor, an abscess, a pleural cavity, a pericardium cavity, or a blood vessel. The organ is optionally a gall bladder. Optionally, the cyst is an ovarian cyst.

These and other features and advantages of the implementations of the present disclosure will become more readily apparent to those skilled in the art upon consideration of the following detailed description and accompanying drawings, which describe both the preferred and alternative implementations of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, like reference numbers and designations in the various drawings indicate like elements.

FIG. 1 is a schematic illustration showing an example surgical aspiration and irrigation device;

FIG. 2 shows a cross-section of an example surgical aspiration and irrigation device with the distal end of the outer cylinder of the device in an advanced position;

FIG. 3 shows a cross-section of an example surgical aspiration and irrigation device with the distal end of the outer cylinder positioned in an intermediate position between the retracted position and the advanced position;

FIG. 4 shows a cross-section of an example surgical aspiration and irrigation device with the distal end of the outer cylinder of the device in a retracted position;

FIGS. 5A and 5B are schematic illustrations showing an example valve in an open and closed position; and

FIG. 6 is a schematic illustration showing an example surgical aspiration and irrigation device.

DETAILED DESCRIPTION

Implementations of the present disclosure now will be described more fully hereinafter. These implementations can be embodied in many different forms and should not be construed as limited to the implementations set forth herein; rather, these implementations are provided by way of example. As used in the specification, and in the appended claims, the singular forms "a," "an," and "the" include plural referents unless the context clearly indicates otherwise. The term "comprising" and variations thereof as used herein is used synonymously with the term "including" and variations thereof and are open, non-limiting terms.

The present disclosure relates generally to surgical aspiration and irrigation devices, including methods of using the same. The present disclosure includes a surgical aspiration and irrigation device. Referring to FIG. 1, an example surgical aspiration and irrigation device is shown. The example surgical aspiration and irrigation device includes an outer cylinder **102** with a distal end **104** and a proximal end **106**. As illustrated in FIGS. 2-4, the distal end **104** is slidably coupled to the proximal end **106** so that the distal end **104** telescopes outward from the proximal end **106** between retracted and advanced positions, as described in more detail below. The outer cylinder **102** is optionally designed to be inserted through a trocar during a medical procedure. Thus, the size of the outer cylinder **102** is optionally chosen based on the size of the trocar and/or location and accessibility of the surgical target. The outer cylinder **102** forms an outer lumen **108**, and the distal end **104** of outer lumen **108** includes a distal opening **110**. The proximal end **106** of the outer cylinder **102** includes a

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connector 112. The connector 112 connects directly or indirectly to a tube, syringe, and/or suction and irrigation handpiece or pump(s). The tube, syringe, or suction and irrigation handpiece optionally connects to one or more pumps (and/or vacuum unit) for providing aspiration and/or irrigation to the surgical aspiration and irrigation device. As used herein, pump is meant to include a unit that either aspirates from a surgical site or a unit that pumps fluid to a surgical site. Optionally a single pumping unit can perform both functions (suction and irrigation).

The surgical aspiration and irrigation device further includes an inner cylinder 114, and the inner cylinder 114 is located within the outer lumen 108. The inner cylinder 114 includes a distal end 116 and a proximal end 118, and the inner cylinder 114 forms an inner lumen 120. The distal end 116 of the inner cylinder 114 includes a needle 122 and a stopper 124. The stopper 124 is configured to close the distal opening 110 of the outer lumen 108 around the needle 122 when the distal opening 110 of the outer lumen 108 approaches the distal end 116 of the inner cylinder 114. Optionally, the needle 122 may include an angled or beveled tip. Furthermore, the distal end 104 of the outer cylinder 102 may include at least one air hole 132. The at least one air hole 132 optionally may prevent tissue or other debris from being aspirated and thereby becoming lodged or otherwise stuck in the inner cylinder 114 and/or outer cylinder 102.

Also provided in the surgical aspiration and irrigation device is a valve 126 positioned at the proximal end 118 of the inner lumen 120. The valve 126 is moveably positioned near the proximal end 106 of the outer lumen 108. The valve 126 selectively controls the aspiration and irrigation through the inner lumen 120 and the outer lumen 108. Further, a seal 128 is positioned about an outer circumference of the valve 126 between the valve 126 and the outer cylinder 102.

The example surgical and aspiration device may also include an advancing element 130 on the exterior portion of the distal end 104 of the outer cylinder 102. Optionally, the advancing element 130 may be connected to the distal end 104 of the outer cylinder 102 in a configuration to advance the distal end 104 of the outer cylinder 102 so that the outer lumen 108 slides over at least a portion of the inner cylinder 114. Thus, the advancing element 130 is designed to move the distal end 104 of the outer cylinder 102 so that the outer lumen 108 slides over at least a portion of the inner cylinder 114. For example, the advancing element 130 may move the distal opening 110 of the outer lumen 108 toward the distal end 116 of the inner cylinder 114. The needle 122 on the distal end 116 of the inner cylinder 114 may optionally be configured to extend through the distal opening 110 of the outer lumen 108 as the distal opening 110 advances toward the distal end 116.

The stopper 124 on the distal end 116 of the inner cylinder 114 may be configured such that the stopper 124 geometrically mates with the distal end 104 of the outer lumen 108. For example, once the stopper 124 geometrically mates with the distal end 104 of the outer lumen 108, the outer lumen 108 stops sliding over the inner cylinder 114 and closes the distal opening 110 of the outer lumen 108 around the needle 122.

Referring now to FIGS. 2-4, an example surgical and aspiration device is shown with the distal end 104 of the outer cylinder 102 in three different positions. Referring to FIG. 2, an example surgical and aspiration device is shown in cross section, revealing the distal end 104 of the outer cylinder 102 in an advanced position. As shown, the distal end 104 of the outer cylinder 102 is optionally in an advanced position when the stopper 124 on the distal end

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116 of the inner cylinder 114 geometrically mates with the distal end 104 of the outer lumen 108. The advanced position is achieved by rotating the distal end 104 of the outer cylinder 102 relative to the proximal end 106 of the outer cylinder 102, or vice versa, so as to move the advancing element 130 distally. In the advanced position, the stopper 124 closes the distal opening 110 of the outer lumen 108 around the needle 122. This position limits or eliminates aspiration or irrigation through the outer lumen 108 and allows aspiration or irrigation from the tip of the needle 122.

Referring to FIG. 4, an example surgical and aspiration device is shown in cross section, with the distal end 104 of the outer cylinder 102 in a retracted position. For example, the distal end 104 of the outer cylinder 102 is optionally in a retracted position when the advancing element 130 moves the distal opening 110 of the outer lumen 108 to a maximum distance from the distal end 116 of the inner cylinder 114. The retracted position is achieved by rotating the distal end 104 of the outer cylinder 102 relative to the proximal end 106 of the outer cylinder 102, or vice versa, to move the advancing element 130 proximally. In this position, irrigation or aspiration can occur through the outer chamber but is not necessarily limited thereto.

As shown in FIG. 1, the exterior portion of the proximal end 106 of the outer cylinder 102 may include a path 202 along which the advancing element 130 travels. The path 202 optionally includes one or more intermediate locking slots 302. Referring to FIG. 3, an example surgical and aspiration device showing the distal end 104 of the outer cylinder 102 in a position between the retracted position and the advanced position is shown. For example, the distal end 104 of the outer cylinder 102 may be positioned between the retracted position and the advanced position when the advancing element 130 is positioned in the one or more intermediate locking slots 302.

Referring to FIGS. 5A and 5B, an example valve is shown. An example valve 126 may include a first layer 502A and a second layer 502B. Each layer 502A, 502B optionally includes at least two approximately equally-shaped openings 510 to the outer lumen 108. The valve 126 may also include a cannula 504 through the approximate center of the two layers 502A, 502B. The cannula 504 is optionally open to the inner lumen 120. The valve 126 may alternate between an open position 506, as shown in FIG. 5A, and a closed position 508, as shown in FIG. 5B, at the proximal end 106 of the outer lumen 108.

As shown in FIG. 5A, the open position 506 optionally includes overlap between the two approximately equally-shaped openings 510 of the first layer 502A with the two approximately equally-shaped openings 510 of the second layer 502B. For example, the valve 126 is optionally in the open position 506 when the inner cylinder 114 is in the retracted position, thereby allowing irrigation or aspiration from the tube, syringe, or suction and irrigation handpiece therethrough the outer lumen 108. Referring now to FIG. 5B, the closed position 508 optionally includes non-overlap between the two approximately equally-shaped openings 510 of the first layer 502A with the two approximately equally-shaped openings 510 of the second layer 502B. For example, the valve 126 is optionally in the closed position 508 when the inner cylinder 114 is in the advanced position, thereby allowing irrigation or aspiration from the tube, syringe, or suction and irrigation handpiece therethrough the inner lumen 120 and preventing irrigation or aspiration therethrough the outer lumen 108.

In an example surgical aspiration and irrigation device, the inner lumen 120 and the outer lumen 108 may be

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configured to aspirate or irrigate therethrough the distal ends of the inner lumen 120 and outer lumen 108. For example, when the inner cylinder 114 is in the advanced position, the inner lumen 120 is optionally configured to aspirate or irrigate and the outer lumen 108 is optionally not configured to aspirate or irrigate.

Referring now to FIG. 6, an example surgical and irrigation device is shown. The inner cylinder 114 of an example surgical and irrigation device may include an inner connector 602. For example, the inner connector 602 may optionally be connected directly or indirectly to a tube, syringe, or suction and irrigation handpiece or pump(s).

Suction and irrigation pumps are known to one of skill in the art. Separate units, one for suction and one for irrigation, are optionally used with the described suction and irrigation device.

Also provided in the present disclosure is a method for aspirating or irrigating a surgical target in a subject. The method includes the insertion of a surgical and aspiration device, as described fully herein, into a subject, optionally during laparoscopic surgery, and then activating irrigation or aspiration from the tube, syringe, or suction and irrigation handpiece or pump(s) connected to the device. The method may be accomplished by insertion of the surgical and aspiration device through a trocar in the subject. For example, the surgical target may include an organ, a cyst, a tumor, an abscess, a pleural cavity, a pericardium cavity, a peritoneum cavity, a vein, a blood vessel, or an artery. For example, the organ optionally may include a gall bladder. The cyst optionally includes an ovarian cyst.

As used throughout, but subject is meant an individual. Preferably, the subject is a mammal such as a primate, and, more preferably, a human. Non-human primates are subjects as well. The term subject includes domesticated animals, such as cats, dogs, etc., livestock (for example, cattle, horses, pigs, sheep, goats, etc.) and laboratory animals (for example, ferret, chinchilla, mouse, rabbit, rat, gerbil, guinea pig, etc.). Thus, veterinary uses and medical uses are contemplated herein.

One of skill in the art would select a suction/irrigation device as shown herein having a selected diameter and length. Should a selection is based on the procedure to be performed, the size and age of the subject, and other factors.

It is understood that the disclosure is not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims.

That which is claimed is:

1. A surgical aspiration and irrigation device, comprising:

an outer cylinder having a distal end and a proximal end and forming an outer lumen, wherein the distal end of the outer lumen comprises a distal opening, and wherein the proximal end of the outer cylinder comprises a connector for connecting directly or indirectly to a tube, syringe, or suction and irrigation handpiece; an inner cylinder located within the outer lumen wherein the inner cylinder has a distal end and a proximal end and forms an inner lumen, wherein the distal end of the inner cylinder comprises a needle and a stopper configured to close the distal opening of the outer lumen around the needle;

an advancing element connected to an exterior portion of the distal end of the outer cylinder, wherein the advancing element is positionable in one or more intermediate locking slots on an exterior portion of the proximal end of the outer cylinder and is configured to move the distal end of the outer cylinder between:

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an advanced position, wherein the distal end of the outer lumen geometrically mates with the stopper on the distal end of the inner cylinder such that the stopper closes the distal opening of the outer lumen around the needle, and

a retracted position, wherein the distal opening of the outer lumen is moved a maximum distance from the distal end of the inner cylinder; and

a valve positioned at the proximal end of the inner lumen and moveably positioned near the proximal end of the outer lumen, wherein the valve is configured to control selectively aspiration and irrigation therethrough the inner lumen and the outer lumen, and wherein a seal is positioned about an outer circumference of the valve between the valve and outer cylinder, wherein the valve comprises

a first layer and a second layer, wherein each layer comprises at least two approximately equally-shaped openings to the outer lumen, and

a cannula through an approximate center of the two layers, wherein the cannula is open to the inner lumen.

2. The surgical aspiration and irrigation device of claim 1, wherein the valve is configured to alternate between an open position and a closed position at the proximal end of the outer lumen.

3. The surgical aspiration and irrigation device of claim 2, wherein the open position comprises overlap between the at least two approximately equally-shaped openings of the first layer with the at least two approximately equally-shaped openings of the second layer.

4. The surgical aspiration and irrigation device of claim 2, wherein the closed position comprises non-overlap between the at least two approximately equally-shaped openings of the first layer with the at least two approximately equally-shaped openings of the second layer.

5. The surgical aspiration and irrigation device of claim 3, wherein the valve is in the open position when the inner cylinder is in the retracted position, thereby allowing irrigation or aspiration from the tube, syringe, or suction and irrigation handpiece therethrough the outer lumen.

6. The surgical aspiration and irrigation device of claim 4, wherein the valve is in the closed position when the inner cylinder is in the advanced position, thereby allowing irrigation or aspiration from the tube, syringe, or suction and irrigation handpiece therethrough the inner lumen and preventing irrigation or aspiration therethrough the outer lumen.

7. The surgical aspiration and irrigation device of claim 1, wherein the inner lumen and the outer lumen are configured to aspirate or irrigate therethrough the distal ends of the inner lumen and the outer lumen.

8. The surgical aspiration and irrigation device of claim 7, wherein, when the inner cylinder is in the advanced position, the inner lumen is configured to aspirate or irrigate and the outer lumen is not configured to aspirate or irrigate.

9. The surgical aspiration and irrigation device of claim 1, wherein the needle comprises an angled tip needle or a bevel tip needle.

10. The surgical aspiration and irrigation device of claim 1, further comprising at least one air hole in the distal end of the outer cylinder, wherein the at least one air hole prevents tissue or other debris from being aspirated and thereby becoming lodged or otherwise stuck in the inner cylinder and/or the outer cylinder.

11. The surgical aspiration and irrigation device of claim **1**, wherein the outer cylinder is designed to be inserted therethrough a trocar.

12. The surgical aspiration and irrigation device of claim **1**, wherein the inner cylinder further comprises an inner 5 connector for connecting to a tube or a syringe.

13. A method of aspirating or irrigating a surgical target in a subject comprising inserting the device of claim **1** into the subject and activating irrigation or aspiration from the tube, syringe, or suction and irrigation handpiece connected 10 to the device.

14. The method of claim **13**, wherein the surgical target comprises a human organ, a cyst, a tumor, an abscess, a pleural cavity, a pericardium cavity, a peritoneum cavity, a vein, a blood vessel, or an artery. 15

15. The method of claim **14**, wherein the organ is a gall bladder.

16. The method of claim **14**, wherein the cyst is an ovarian cyst.

17. The method of claim **13**, wherein the device of claim 20 **1** is inserted through a trocar in the subject.

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